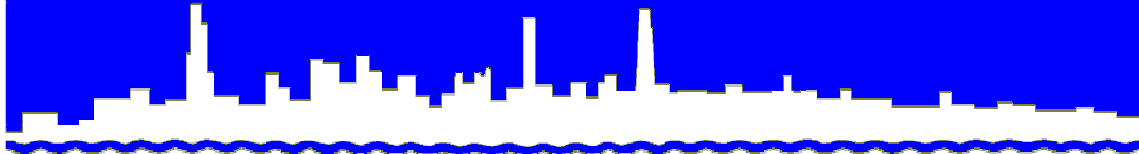


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***RESEARCH AND DEVELOPMENT
DEPARTMENT***

REPORT NO. 06-42

GROUNDWATER MONITORING REPORT

***TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2005 ANNUAL REPORT***

AUGUST 2006

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August 8, 2006

Ms. Marcia Willhite, Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Subject: Calumet TARP System Groundwater Monitoring Annual Report for the
Year 2005

Dear Ms. Willhite:

Enclosed are three copies of "Groundwater Monitoring Report, Tunnel and Reservoir Plan
Calumet Tunnel System 2005 Annual Report."

Very truly yours,

Louis Kollias
Director
Research and Development

LK:JSJ:lmf

Enclosures

cc w/enc: Ms. Sally K. Swanson (USEPA Region V—WC15J)

(2)

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GROUNDWATER MONITORING REPORT

TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2005 ANNUAL REPORT

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**GROUNDWATER MONITORING REPORT
TUNNEL AND RESERVOIR PLAN (TARP)
CALUMET TUNNEL SYSTEM
2005 ANNUAL REPORT**

Introduction

This report contains 2005 data for the TARP Calumet Tunnel System compiled from the monitoring of the groundwater level elevations in the observation wells and monitoring of water quality in the water quality monitoring wells. The observation and monitoring wells are located along the Calumet Tunnel System. The tunnel between Crawford Avenue and the Calumet Water Reclamation Plant has four water quality wells (QC-1, QC-2, QC-2.1, and QC-2.2) and 11 observation wells (OC-1 through OC-11). The tunnel between 140th Street and Indiana Avenue has 17 water quality wells (QC-3 through QC-19). The tunnel on the Torrence Avenue leg has nine water quality wells (QC-20 through QC-28). The tunnel along the Little Calumet leg has nine water quality wells (QC-29 through QC-37).

Water quality monitoring wells QC-1, QC-2, QC-20, QC-23, QC-24, and QC-26 are sampled six times per year (Illinois Environmental Protection Agency [IEPA] memorandum July 9, 2004). Water quality monitoring wells QC-2.1, QC-2.2, QC-3 through QC-7, QC-9 through QC-19 (QC-8.1 is a dry well), QC-21, QC-22, QC-25, QC-27 and QC-28 are sampled three times per year (IEPA memo July 9, 2004). Water quality monitoring wells QC-29 through QC-37 are sampled six times per year as required. Water level readings are taken at the same frequency. Groundwater observation wells OC-1 through OC-11 are sampled once every two weeks.

Monitoring Data

Appendix AI contains a location map of observation wells OC-1 through OC-11 located along the Calumet Tunnel System.

Table AII-1 in Appendix AII contains groundwater level observation data for 2005 for observation wells OC-1 through OC-11 shown in Appendix AI. Table AII-1 also contains the yearly minimum, mean, and maximum water level elevations of each observation well.

Appendix AIII contains a location map of the water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 through QC-7, and QC-9 through QC-37 located along the Calumet Tunnel System.

Tables AIV-1 and AIV-2 in Appendix AIV contain water quality monitoring data for 2005 pertaining to the water quality wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for QC-8.1 which is a dry well) along the Calumet Tunnel System shown in Appendix AIII.

All of the wells in the Calumet system were visited for the required number of samples. However, in some instances the samples could not be collected. Water quality well QC-20 was not sampled on January 13, 2005, March 8, 2005, May 18, 2005, August 25, 2005, November 1, 2005, or December 16, 2005, because the pump housing broke and the pump was inaccessible. QC-20 is a very deep well and as such it has been difficult to locate the pump. Industrial Waste Division personnel are working to resolve this problem with the assistance of the Maintenance and

Operations Department. Water quality well QC-29 was not sampled on March 23, 2005, because the pump could not be activated. Water quality well QC-30 could not be sampled on January 6, 2005, or March 23, 2005, because there was a pump malfunction. Water quality well QC-31 could not be sampled on March 23, 2005, because of a pump malfunction. Water quality well QC-32 could not be sampled on March 23, 2005, May 5, 2005, July 20, 2005, September 1, 2005, or November 10, 2005, because there was insufficient water in the well to collect a sample. Water quality wells QC-33 through QC-37 were not sampled during 2005 because there was insufficient water in the wells to collect a sample.

Summary of Data

Observation Wells Water Level Elevation Data. In [Figure 1](#), the 2005 groundwater level elevation data for the observation wells (OC-1 through OC-11) of the Calumet Tunnel System have been plotted. In this figure, yearly minimum, mean, and maximum water level elevations of all 11

wells are plotted to show fluctuations in the water level elevations during 2005. [Table AII-1](#) in [Appendix AII](#) contains the entire groundwater level elevation data for 2005 for all the observation wells in the Calumet Tunnel System.

Water Quality Monitoring Wells Data. [Tables 1](#) through [8](#) contain summary statistics of the water quality parameters for 2005 for water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for well QC-8.1 which is a dry well) in the Calumet Tunnel System. These statistics were computed from the data collected from each water quality monitoring well in 2005. The summary statistics include minimum, mean, maximum, standard deviation (Std. Dev.), median and coefficient of variation (Coeff. Var.) for the nine water quality parameters analyzed during 2005. The nine water quality parameters are: chloride (Cl), conductivity (Cond.), fecal coliform (FC), hardness as CaCO₃ (Hard.), ammonia as NH₄⁺-N, pH, sulfate (SO₄), total dissolved solids (TDS), and total organic carbon (TOC).

Figure 1: 2005 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE CALUMET TUNNEL SYSTEM OBSERVATION WELLS

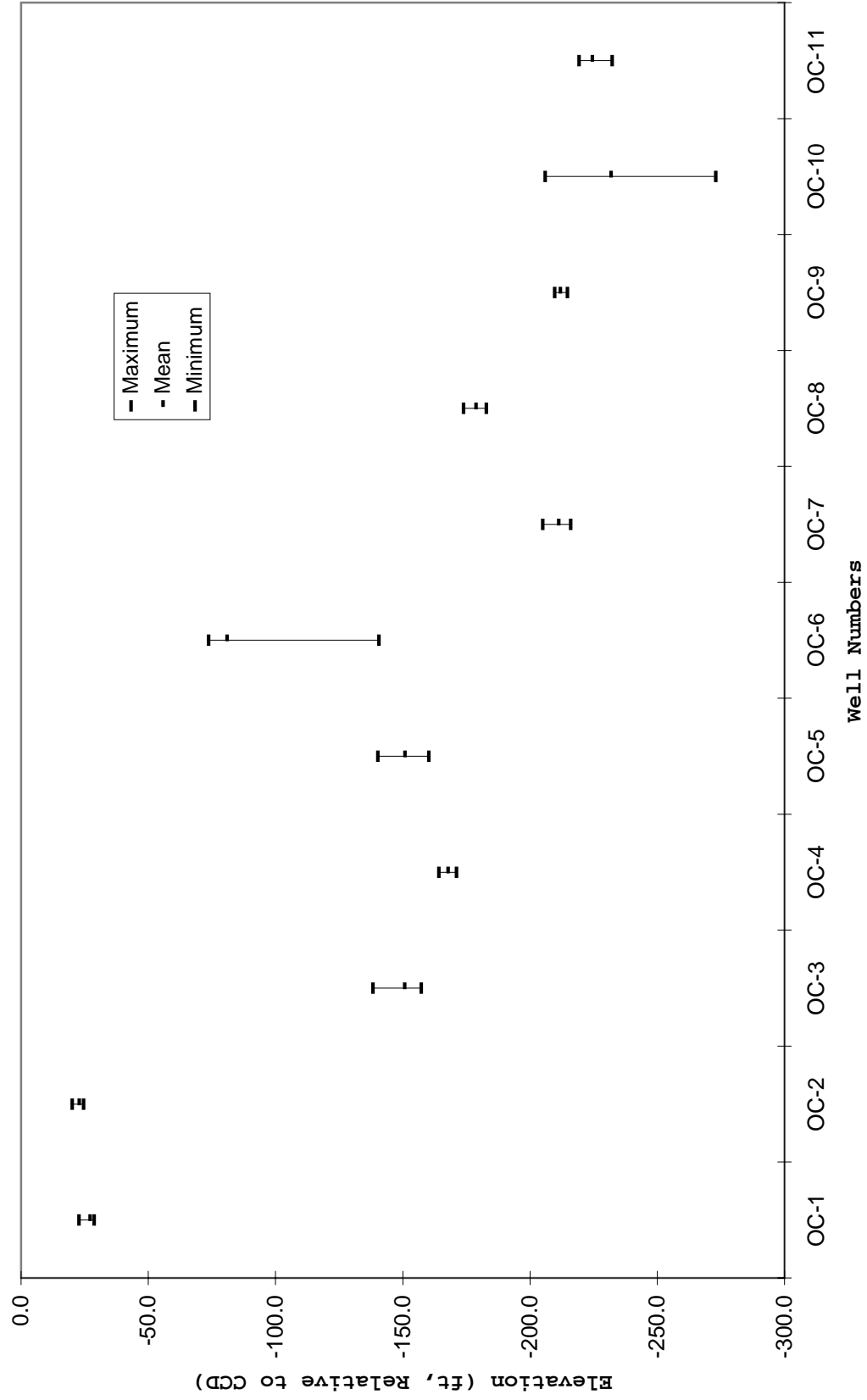


TABLE 1: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter		Well Number				
		QC-1	QC-2	QC-2.1	QC-2.2	QC-3
Cl, mg/L	Minimum	61	30	34	14	11
	Mean	64	38	35	15	12
	Maximum	67	44	36	16	12
	Std. Dev.	2	5	1	1	1
	Median	64	38	35	15	12
	Coeff. Var.	3	14	3	7	5
Cond., µmhos/cm	Minimum	293	261	356	261	330
	Mean	641	404	547	353	397
	Maximum	949	490	674	437	495
	Std. Dev.	278	87	168	88	87
	Median	672	419	610	361	367
	Coeff. Var.	43	21	31	25	22
FC,* cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	2	1	1	1
	Maximum	1	120	1	1	1
	Geo. Std. Dev.	0	20	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	901	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	504	77	55	41	63
	Mean	527	85	59	42	64
	Maximum	548	96	62	43	65
	Std. Dev.	16	7	4	1	1
	Median	529	84	60	41	65
	Coeff. Var.	3	8	6	3	2
NH ₄ ⁺ -N, mg/L	Minimum	0.29	0.21	0.42	0.25	0.34
	Mean	0.36	0.61	0.52	0.41	0.39
	Maximum	0.43	0.99	0.57	0.54	0.43
	Std. Dev.	0.05	0.27	0.08	0.15	0.05
	Median	0.35	0.68	0.56	0.43	0.39
	Coeff. Var.	13.99	44.42	16.23	36.00	11.66

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter	Well Number					
	QC-1	QC-2	QC-2.1	QC-2.2	QC-3	
pH	Minimum	7.2	6.9	7.5	7.4	6.9
	Mean	7.4	7.4	7.6	7.6	7.3
	Maximum	7.6	7.7	7.6	7.7	7.6
	Std. Dev.	0.2	0.3	0.1	0.2	0.4
	Median	7.5	7.4	7.6	7.6	7.4
	Coeff. Var.	2.0	3.7	0.8	2.0	4.9
SO ₄ , mg/L	Minimum	223	24	0**	32	23
	Mean	241	27	2	57	24
	Maximum	256	29	5	105	25
	Std. Dev.	13	2	3	42	1
	Median	237	27	1	34	24
	Coeff. Var.	5	6	132	73	4
TDS, mg/L	Minimum	746	340	496	336	368
	Mean	826	388	579	369	399
	Maximum	884	412	702	388	424
	Std. Dev.	50	27	108	28	29
	Median	830	394	540	382	406
	Coeff. Var.	6	7	19	8	7
TOC, mg/L	Minimum	2	1	1	1	1
	Mean	3	3	1	2	1
	Maximum	4	4	2	3	2
	Std. Dev.	1	1	1	1	1
	Median	3	3	1	2	1
	Coeff. Var.	30	45	43	50	43

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**A zero value indicates that the test result was below the detection limit (DL). The DL for sulfate is 0.4 mg/L.

TABLE 2: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter	Well Number					
	QC-4	QC-5	QC-6	QC-7	QC-9	
Cl, mg/L	Minimum	10	27	15	11	9
	Mean	11	28	16	12	10
	Maximum	11	30	16	12	10
	Std. Dev.	1	2	1	1	1
	Median	11	28	16	12	10
	Coeff. Var.	5	5	4	5	6
Cond., µmhos/cm	Minimum	340	505	417	509	296
	Mean	440	579	490	548	358
	Maximum	541	720	617	584	397
	Std. Dev.	101	122	110	38	54
	Median	439	512	436	550	380
	Coeff. Var.	23	21	23	7	15
FC,* cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	10	9	9	10	58
	Mean	10	10	16	12	60
	Maximum	11	10	19	15	61
	Std. Dev.	1	1	6	3	2
	Median	10	10	19	12	60
	Coeff. Var.	6	6	37	20	3
NH ₄ ⁺ -N, mg/L	Minimum	0.13	0.15	0.29	0.25	0.18
	Mean	0.15	0.15	0.32	0.27	0.33
	Maximum	0.19	0.16	0.36	0.28	0.59
	Std. Dev.	0.03	0.01	0.04	0.02	0.23
	Median	0.13	0.15	0.30	0.27	0.21
	Coeff. Var.	23.09	3.77	11.96	5.73	69.96

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter	Well Number					
	QC-4	QC-5	QC-6	QC-7	QC-9	
pH	Minimum	7.1	6.8	7.1	7.1	7.4
	Mean	7.4	7.2	7.3	7.3	7.4
	Maximum	7.6	7.9	7.5	7.6	7.5
	Std. Dev.	0.3	0.6	0.2	0.3	0.1
	Median	7.4	7.0	7.4	7.1	7.4
	Coeff. Var.	3.4	8.1	2.8	4.0	0.8
SO ₄ , mg/L	Minimum	14	9	12	2	29
	Mean	14	10	13	3	30
	Maximum	15	10	14	4	30
	Std. Dev.	1	1	1	1	1
	Median	14	10	14	2	30
	Coeff. Var.	4	6	9	43	2
TDS, mg/L	Minimum	418	528	446	346	294
	Mean	423	592	487	385	318
	Maximum	430	698	526	418	362
	Std. Dev.	6	92	40	36	38
	Median	420	550	488	392	297
	Coeff. Var.	2	16	8	9	12
TOC, mg/L	Minimum	1	2	1	2	1
	Mean	1	2	2	2	2
	Maximum	1	3	3	2	2
	Std. Dev.	0	1	1	0	1
	Median	1	2	2	2	2
	Coeff. Var.	0	25	50	0	35

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

TABLE 3: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-10 THROUGH QC-14

Parameter		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
Cl, mg/L	Minimum	29	21	37	43	85
	Mean	32	22	41	46	89
	Maximum	36	22	47	48	95
	Std. Dev.	4	1	5	3	5
	Median	31	22	40	46	88
	Coeff. Var.	11	3	12	6	6
Cond., µmhos/cm	Minimum	369	289	701	446	475
	Mean	411	329	945	504	606
	Maximum	488	350	1069	555	852
	Std. Dev.	67	34	211	55	213
	Median	376	347	1065	512	490
	Coeff. Var.	16	10	22	11	35
FC,* cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	11	19	115	33	105
	Mean	12	21	154	34	107
	Maximum	13	22	200	35	111
	Std. Dev.	1	2	43	1	3
	Median	12	22	146	34	106
	Coeff. Var.	8	8	28	3	3
NH ₄ ⁺ -N, mg/L	Minimum	0.05	0.11	0.25	0.17	0.17
	Mean	0.08	0.14	0.27	0.18	0.21
	Maximum	0.10	0.19	0.30	0.19	0.27
	Std. Dev.	0.03	0.04	0.03	0.01	0.05
	Median	0.09	0.12	0.26	0.18	0.19
	Coeff. Var.	33.07	31.13	9.80	5.56	25.20

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-10 THROUGH QC-14

Parameter		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
pH	Minimum	7.6	7.1	6.9	7.1	7.1
	Mean	7.6	7.5	7.2	7.4	7.5
	Maximum	7.7	7.8	7.5	7.6	7.7
	Std. Dev.	0.1	0.4	0.3	0.3	0.3
	Median	7.6	7.6	7.3	7.4	7.6
	Coeff. Var.	0.8	4.8	4.2	3.4	4.3
SO ₄ , mg/L	Minimum	0**	1	199	40	0**
	Mean	1	1	264	42	1
	Maximum	1	2	354	45	3
	Std. Dev.	1	1	80	3	2
	Median	1	1	239	41	1
	Coeff. Var.	87	43	30	6	115
TDS, mg/L	Minimum	314	214	728	406	662
	Mean	375	246	818	457	666
	Maximum	408	290	968	500	670
	Std. Dev.	53	39	131	48	6
	Median	402	234	758	466	666
	Coeff. Var.	14	16	16	10	1
TOC, mg/L	Minimum	1	1	1	1	2
	Mean	2	1	1	1	3
	Maximum	4	1	2	2	4
	Std. Dev.	2	0	1	1	1
	Median	1	1	1	1	2
	Coeff. Var.	87	0	43	43	43

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**A zero value indicates that the test result was below the detection limit (DL). The DL for sulfate is 0.4 mg/L.

TABLE 4: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-15 THROUGH QC-19

Parameter		Well Number				
		QC-15	QC-16	QC-17	QC-18	QC-19
Cl, mg/L	Minimum	20	21	13	8	4
	Mean	20	21	13	8	5
	Maximum	21	22	14	8	5
	Std. Dev.	1	1	1	0	1
	Median	20	21	13	8	5
	Coeff. Var.	3	3	4	0	12
Cond., µmhos/cm	Minimum	292	354	352	332	565
	Mean	342	437	497	405	574
	Maximum	393	587	643	479	582
	Std. Dev.	51	130	146	74	9
	Median	340	370	495	404	574
	Coeff. Var.	15	30	29	18	1
FC,* cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	13	74	170	7	114
	Mean	13	75	182	7	117
	Maximum	14	76	188	7	119
	Std. Dev.	1	1	10	0	3
	Median	13	75	187	7	119
	Coeff. Var.	4	1	6	0	2
NH ₄ ⁺ -N, mg/L	Minimum	0.17	0.04	0.27	0.08	0.27
	Mean	0.18	0.05	0.28	0.09	0.28
	Maximum	0.19	0.07	0.29	0.09	0.28
	Std. Dev.	0.01	0.02	0.01	0.01	0.01
	Median	0.18	0.04	0.28	0.09	0.28
	Coeff. Var.	5.56	34.64	3.57	6.66	2.09

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-15 THROUGH QC-19

Parameter	Well Number					
	QC-15	QC-16	QC-17	QC-18	QC-19	
pH	Minimum	7.0	7.2	7.5	7.5	6.9
	Mean	7.7	7.4	7.6	8.0	7.1
	Maximum	8.2	7.6	7.7	8.7	7.4
	Std. Dev.	0.6	0.2	0.1	0.6	0.3
	Median	7.8	7.3	7.6	7.9	7.0
	Coeff. Var.	8.0	2.8	1.3	7.6	3.7
SO ₄ , mg/L	Minimum	0**	49	191	33	158
	Mean	1	53	192	36	163
	Maximum	1	55	194	38	169
	Std. Dev.	1	3	2	3	6
	Median	1	54	192	37	161
	Coeff. Var.	87	6	1	7	3
TDS, mg/L	Minimum	332	464	546	364	396
	Mean	365	509	555	396	449
	Maximum	426	570	568	426	482
	Std. Dev.	53	55	11	31	47
	Median	336	494	552	398	470
	Coeff. Var.	15	11	2	8	10
TOC, mg/L	Minimum	1	0**	1	0**	1
	Mean	1	1	1	0	1
	Maximum	2	1	1	1	2
	Std. Dev.	1	1	0	1	1
	Median	1	1	1	0	1
	Coeff. Var.	43	87	0	173	43

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**A zero value indicates that the test result was below the detection limit (DL). The DLs for sulfate and total organic carbon are 0.4 mg/L and 0.3 mg/L, respectively.

TABLE 5: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-20 THROUGH QC-24

Parameter		Well Number				
		QC-20**	QC-21	QC-22	QC-23	QC-24
Cl, mg/L	Minimum	—	16	14	19	26
	Mean	—	21	15	20	26
	Maximum	—	29	15	21	27
	Std. Dev.	—	7	1	1	1
	Median	—	17	15	20	26
	Coeff. Var.	—	35	4	4	2
Cond., µmhos/cm	Minimum	—	311	255	291	215
	Mean	—	341	280	359	266
	Maximum	—	360	296	436	324
	Std. Dev.	—	26	22	52	39
	Median	—	351	290	346	262
	Coeff. Var.	—	8	8	14	15
FC,* cfu/100 mL	Minimum	—	1	1	1	1
	Geo. Mean	—	1	1	1	1
	Maximum	—	1	1	1	1
	Geo. Std. Dev.	—	0	0	0	0
	Median	—	1	1	1	1
	Coeff. Var.	—	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	—	10	24	5	10
	Mean	—	10	26	6	11
	Maximum	—	11	27	7	11
	Std. Dev.	—	1	2	1	0.41
	Median	—	10	26	6	11
	Coeff. Var.	—	6	6	11	4
NH ₄ ⁺ -N, mg/L	Minimum	—	0.03	0.11	0.04	0.09
	Mean	—	0.25	0.16	0.07	0.11
	Maximum	—	0.63	0.19	0.10	0.13
	Std. Dev.	—	0.33	0.04	0.03	0.02
	Median	—	0.09	0.18	0.07	0.10
	Coeff. Var.	—	132.18	27.24	36.14	18.81

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-20 THROUGH QC-24

Parameter	Well Number					
	QC-20**	QC-21	QC-22	QC-23	QC-24	
pH	Minimum	—	7.5	7.5	7.6	7.5
	Mean	—	7.5	7.5	7.8	7.6
	Maximum	—	7.6	7.6	7.9	7.8
	Std. Dev.	—	0.1	0.1	0.1	0.1
	Median	—	7.5	7.5	7.8	7.6
	Coeff. Var.	—	0.8	0.8	1.3	1.4
SO ₄ , mg/L	Minimum	—	0***	2	0***	0***
	Mean	—	1	2	1	1
	Maximum	—	1	2	1	5
	Std. Dev.	—	1	0	1	2
	Median	—	1	2	1	1
	Coeff. Var.	—	87	0	110	140
TDS, mg/L	Minimum	—	256	179	292	212
	Mean	—	321	240	332	257
	Maximum	—	358	290	352	288
	Std. Dev.	—	57	56	22	26
	Median	—	350	252	335	261
	Coeff. Var.	—	18	23	6	10
TOC, mg/L	Minimum	—	1	1	0***	0***
	Mean	—	3	2	1	1
	Maximum	—	7	2	2	1
	Std. Dev.	—	3	1	1	1
	Median	—	2	2	1	1
	Coeff. Var.	—	96	35	90	77

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**Well could not be sampled.

***A zero value indicates that the test result was below the detection limit (DL). The DL for sulfate and total organic carbon are 0.4 mg/L and 0.3 mg/L, respectively.

TABLE 6: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-25 THROUGH QC-29

Parameter		Well Number				
		QC-25	QC-26	QC-27	QC-28	QC-29
Cl, mg/L	Minimum	14	11	32	13	59
	Mean	15	12	32	19	71
	Maximum	16	12	33	29	88
	Std. Dev.	1	0.41	1	9	11
	Median	14	12	32	16	69
	Coeff. Var.	8	3	2	44	15
Cond., µmhos/cm	Minimum	215	218	256	234	475
	Mean	247	305	282	272	639
	Maximum	268	374	318	311	737
	Std. Dev.	28	58	32	39	99
	Median	257	304	271	271	663
	Coeff. Var.	11	19	11	14	16
FC,* cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	17	6	23	15	149
	Mean	18	7	25	16	162
	Maximum	19	7	26	17	177
	Std. Dev.	1	1	2	1	13
	Median	18	7	26	16	156
	Coeff. Var.	6	8	7	6	8
NH ₄ ⁺ -N, mg/L	Minimum	0.10	0.00**	0.11	0.01	0.35
	Mean	0.13	0.04	0.13	0.03	0.48
	Maximum	0.16	0.07	0.16	0.06	0.54
	Std. Dev.	0.03	0.03	0.03	0.03	0.07
	Median	0.14	0.05	0.13	0.03	0.49
	Coeff. Var.	22.91	66.88	18.87	75.50	15.62

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-25 THROUGH QC-29

Parameter		Well Number				
		QC-25	QC-26	QC-27	QC-28	QC-29
pH	Minimum	7.5	7.5	7.5	7.6	7.0
	Mean	7.7	7.8	7.6	7.7	7.5
	Maximum	7.9	8.0	7.7	7.8	7.8
	Std. Dev.	0.2	0.2	0.1	0.1	0.3
	Median	7.7	7.8	7.6	7.8	7.5
	Coeff. Var.	2.6	2.4	1.3	1.5	3.9
SO ₄ , mg/L	Minimum	0**	0**	0**	0**	90
	Mean	1	1	0	1	97
	Maximum	1	2	1	1	106
	Std. Dev.	1	1	1	1	7
	Median	1	1	0	1	97
	Coeff. Var.	87	63	173	87	8
TDS, mg/L	Minimum	178	228	248	252	552
	Mean	223	276	256	261	570
	Maximum	246	298	266	272	608
	Std. Dev.	39	25	9	10	22
	Median	244	280	254	260	564
	Coeff. Var.	17	9	4	4	4
TOC, mg/L	Minimum	1	0**	1	1	1
	Mean	1	1	1	2	1
	Maximum	1	1	1	2	1
	Std. Dev.	0	1	0	1	0
	Median	1	1	1	2	1
	Coeff. Var.	0	77	0	35	0

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**A zero value indicates that the test result was below the detection limit (DL). The DLs for ammonia nitrogen, sulfate, and total organic carbon are 0.02 mg/L, 0.4 mg/L, and 0.3 mg/L, respectively.

TABLE 7: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-30 THROUGH QC-34

Parameter		Well Number				
		QC-30	QC-31	QC-32	QC-33**	QC-34**
Cl, mg/L	Minimum	14	21	28	—	—
	Mean	15	26	28	—	—
	Maximum	16	28	28	—	—
	Std. Dev.	1	3	0	—	—
	Median	15	27	28	—	—
	Coeff. Var.	6	11	0	—	—
Cond., µmhos/cm	Minimum	481	494	545	—	—
	Mean	509	638	545	—	—
	Maximum	532	706	545	—	—
	Std. Dev.	22	83	0	—	—
	Median	512	669	545	—	—
	Coeff. Var.	4	13	0	—	—
FC,* cfu/100 mL	Minimum	1	1	1	—	—
	Geo. Mean	1	1	1	—	—
	Maximum	1	1	1	—	—
	Geo. Std. Dev.	0	0	0	—	—
	Median	1	1	1	—	—
	Coeff. Var.	0	0	0	—	—
Hard., as CaCO ₃ , mg/L	Minimum	57	230	46	—	—
	Mean	60	245	46	—	—
	Maximum	63	253	46	—	—
	Std. Dev.	3	9	0	—	—
	Median	60	246	46	—	—
	Coeff. Var.	4	4	0	—	—
NH ₄ ⁺ -N, mg/L	Minimum	0.06	0.78	0.63	—	—
	Mean	0.09	0.92	0.63	—	—
	Maximum	0.11	1.03	0.63	—	—
	Std. Dev.	0.02	0.09	0.00	—	—
	Median	0.10	0.94	0.63	—	—
	Coeff. Var.	24.00	9.82	0.00	—	—

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-30 THROUGH QC-34

Parameter		Well Number				
		QC-30	QC-31	QC-32	QC-33**	QC-34**
pH	Minimum	7.2	7.3	7.9	—	—
	Mean	7.4	7.5	7.9	—	—
	Maximum	7.5	7.7	7.9	—	—
	Std. Dev.	0.2	0.2	0.0	—	—
	Median	7.5	7.4	7.9	—	—
	Coeff. Var.	2.0	2.0	0.0	—	—
SO ₄ , mg/L	Minimum	70	166	1	—	—
	Mean	71	172	1	—	—
	Maximum	74	184	1	—	—
	Std. Dev.	2	7	0	—	—
	Median	71	169	1	—	—
	Coeff. Var.	3	4	0	—	—
TDS, mg/L	Minimum	432	544	8	—	—
	Mean	441	558	8	—	—
	Maximum	450	576	8	—	—
	Std. Dev.	7	16	0	—	—
	Median	441	550	8	—	—
	Coeff. Var.	2	3	0	—	—
TOC, mg/L	Minimum	1	1	49	—	—
	Mean	1	1	49	—	—
	Maximum	2	2	49	—	—
	Std. Dev.	1	0.45	0	—	—
	Median	1	1	49	—	—
	Coeff. Var.	40	37	0	—	—

*For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

**No samples were obtained, the well was dry during 2005.

TABLE 8: SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-35 THROUGH QC-37

Parameter		Well Number		
		QC-35*	QC-36*	QC-37*
Cl, mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
Cond., µmhos/cm	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
FC, cfu/100 mL	Minimum	—	—	—
	Geo. Mean	—	—	—
	Maximum	—	—	—
	Geo. Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
Hard., as CaCO ₃ , mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
NH ₄ ⁺ —N, mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—

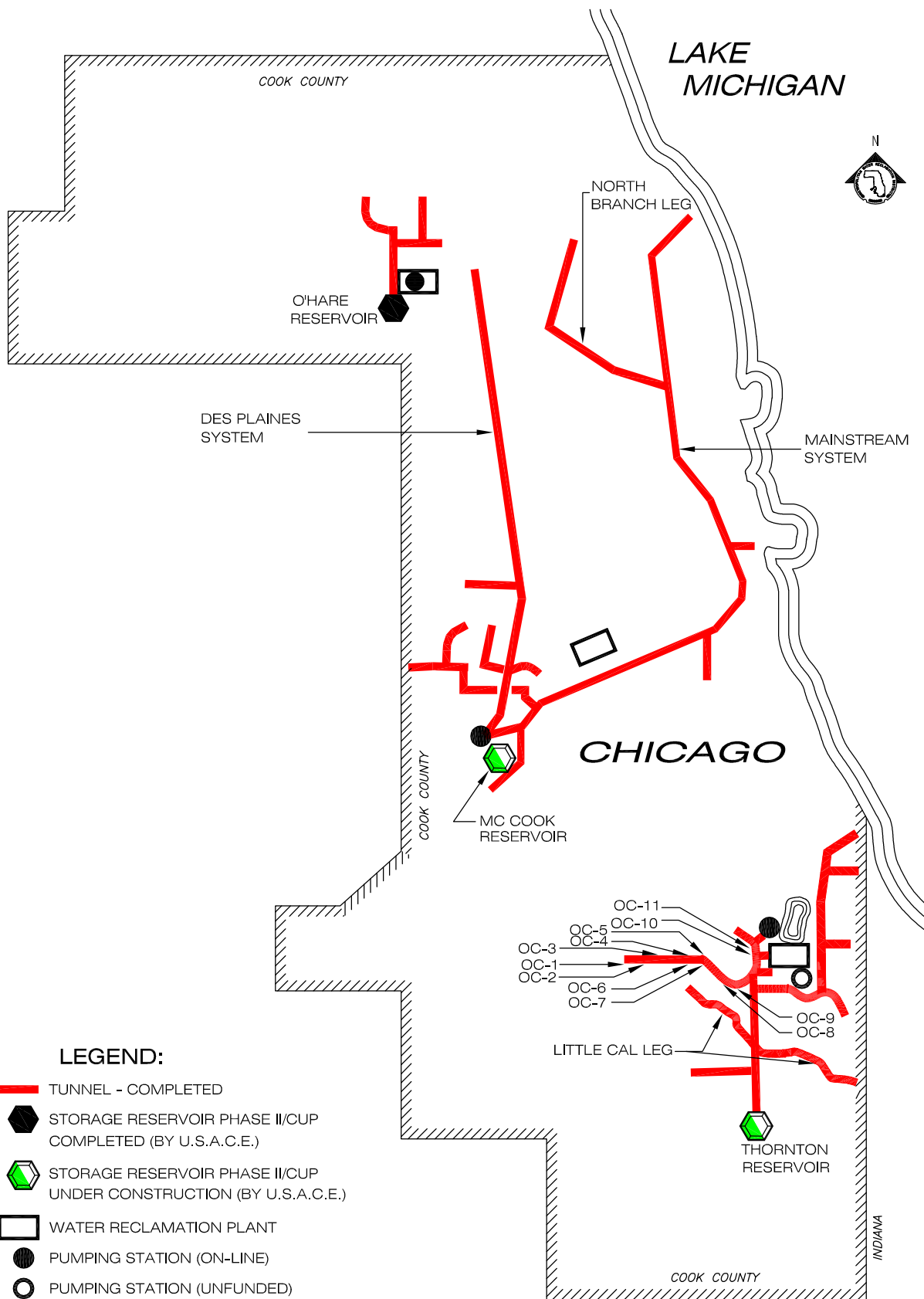
TABLE 8 (Continued): SUMMARY STATISTICS OF THE 2005 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-35 THROUGH QC-37

Parameter	Well Number			
	QC-35*	QC-36*	QC-37*	
pH	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
SO ₄ , mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
TDS, mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—
TOC, mg/L	Minimum	—	—	—
	Mean	—	—	—
	Maximum	—	—	—
	Std. Dev.	—	—	—
	Median	—	—	—
	Coeff. Var.	—	—	—

*No samples were obtained, the well was dry during 2005.

APPENDIX AI

LOCATION MAP OF GROUNDWATER OBSERVATION WELLS
OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF
GROUNDWATER OBSERVATION WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AII

2005 GROUNDWATER LEVEL ELEVATION DATA
FOR OBSERVATION WELLS OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM

TABLE AII-1: 2005 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well					
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6
	feet					
1/12/05	-25.8	-22.6	-151.3	-170.2	-160.3	-78.7
1/28/05	-25.8	-21.1	-148.3	-167.2	-148.3	-74.2
2/4/05	-25.8	-23.6	-150.3	-168.2	-149.3	-73.7
2/24/05	-22.8	-20.6	-138.3	-167.2	***	-73.7
3/4/05	-23.8	-21.6	-144.3	-167.2	-149.8	-75.7
3/18/05	-24.8	-22.1	-150.3	-167.2	-149.3	-80.7
4/15/05	-26.3	-23.1	-152.3	-168.2	-150.8	-81.7
5/6/05	-26.8	-22.6	-152.3	-171.2	-151.3	-83.7
5/20/05	-26.8	-22.6	-152.3	-167.7	-150.3	-80.7
6/3/05	-26.8	-22.6	-153.3	-168.2	-153.3	-140.7
6/17/05	-27.3	-22.6	-152.8	-167.7	-150.8	-80.7
7/1/05	-26.8	-20.1	-138.3	-164.2	-140.3	-76.7
7/15/05	-28.8	-23.6	-153.3	-168.2	-151.3	-80.7
8/5/05	-27.8	-23.6	-153.3	-168.2	-151.3	-79.7
8/12/05	-28.8	-22.6	-152.3	-168.2	-152.3	-79.7
8/26/05	-28.8	-24.6	-152.3	-167.2	-150.3	-78.7
9/9/05	-27.8	-23.6	-152.3	-167.2	-151.3	-78.7
9/26/05	-28.8	-23.6	-152.3	-166.2	-151.3	-78.7
10/7/05	-28.3	-23.6	-152.3	-168.2	-151.3	-78.7
10/21/05	-28.3	-23.6	-152.3	-168.2	-151.8	-78.7
10/28/05	-28.8	-24.6	-153.3	-168.2	-152.3	-75.7
11/18/05	-28.3	-23.6	-152.3	-167.7	-151.8	-79.2
11/29/05	-28.8	-23.6	-157.3	-168.2	-151.3	-78.2
12/2/05	-28.8	-23.6	-152.3	-167.7	-151.8	-79.2
12/16/05	-28.8	*****	-150.3	*****	-149.3	-77.7
Minimum	-28.8	-24.6	-157.3	-171.2	-160.3	-140.7
Mean	-27.2	-22.9	-150.8	-167.8	-150.9	-81.0
Maximum	-22.8	-20.1	-138.3	-164.2	-140.3	-73.7

TABLE AII-1 (Continued): 2005 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well				
	OC-7	OC-8	OC-9	OC-10	OC-11
feet					
1/12/05	-210.0	**	-212.7	-217.0	-222.3
1/28/05	-205.0	-173.9	-211.2	-216.5	-221.3
2/4/05	-205.0	-174.9	-211.7	-220.0	-222.3
2/24/05	-205.0	****	-209.7	-206.0	-223.3
3/4/05	-206.5	****	-209.7	-217.0	-222.3
3/18/05	-208.0	****	-209.7	-219.5	-221.3
4/15/05	-210.0	-180.9	-211.7	-222.5	-224.3
5/6/05	-211.0	-181.9	-210.7	-225.0	-224.3
5/20/05	-211.0	-180.4	-210.7	-225.0	-222.3
6/3/05	-214.0	-182.9	-214.7	-226.0	-222.3
6/17/05	-212.0	-179.9	-211.2	-227.0	-223.3
7/1/05	-210.0	-176.9	-211.7	-225.0	-219.3
7/15/05	-214.0	-178.9	-212.7	-233.0	-224.3
8/5/05	-213.0	-178.9	-211.7	-234.0	-224.3
8/12/05	-213.0	-176.9	-211.7	-234.0	-225.3
8/26/05	-209.0	-176.9	-212.7	-241.0	-225.3
9/9/05	-214.0	-178.9	-212.7	-240.0	-225.8
9/26/05	-214.0	-178.9	-212.7	-239.0	-226.3
10/7/05	-214.0	-179.9	-213.2	-243.0	-226.3
10/21/05	-213.5	-178.9	-212.7	-243.0	-227.3
10/28/05	-214.0	-179.9	-213.7	-273.0	-232.3
11/18/05	-215.0	-179.9	-212.7	-245.0	-227.3
11/29/05	-214.0	-178.9	-213.7	-243.0	-226.3
12/2/05	-216.0	-179.9	-213.7	-243.0	-227.3
12/16/05	-213.0	-177.9	-210.7	-239.0	-226.3
Minimum	-216.0	-182.9	-214.7	-273.0	-232.3
Mean	-211.4	-178.9	-212.0	-231.9	-224.5
Maximum	-205.0	-173.9	-209.7	-206.0	-219.3

*Relative to Chicago City Datum.

**Gate locked, no access.

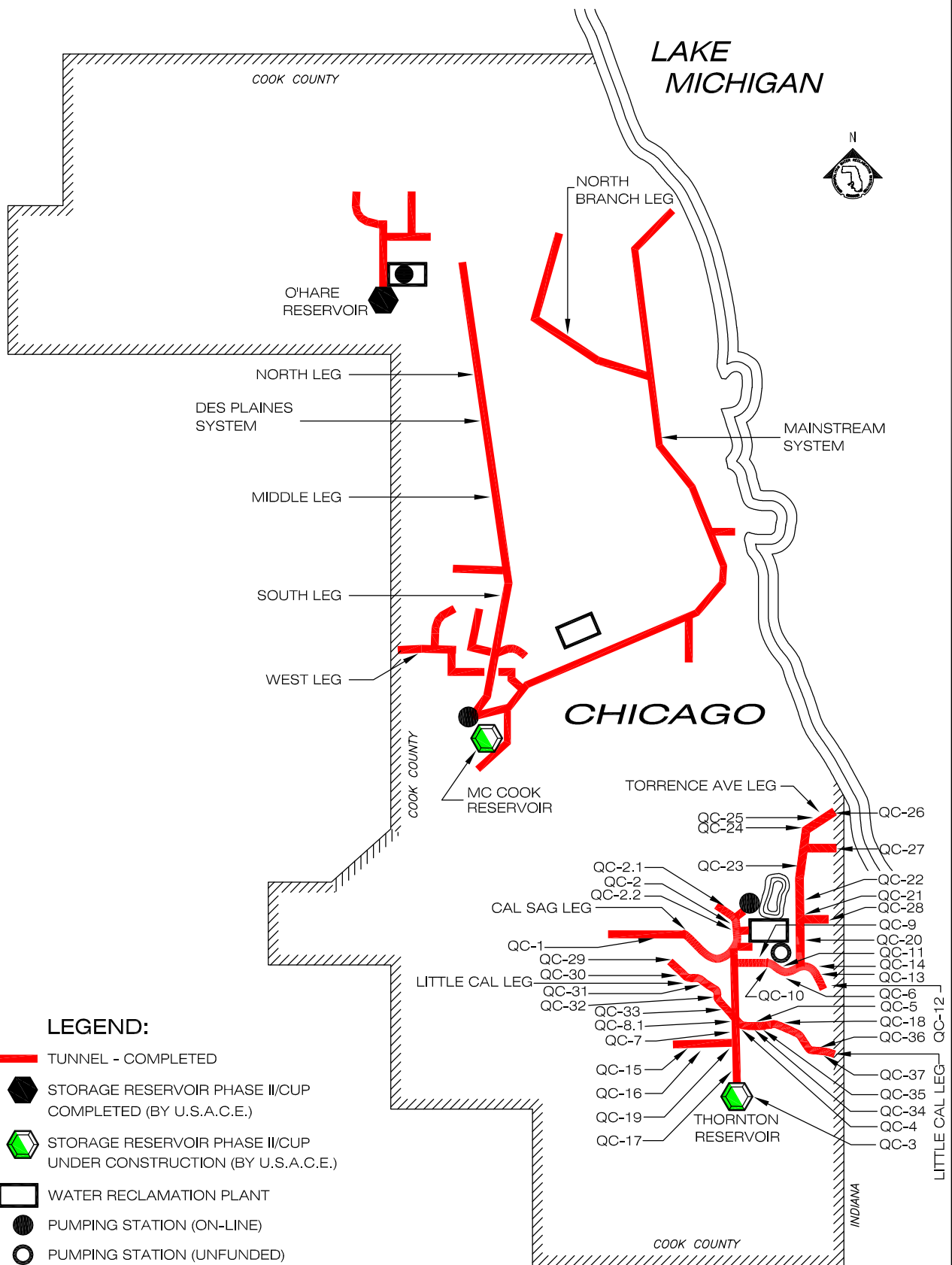
***Construction vehicles blocked access to well.

****Unable to take reading because the area was flooded.

*****No access because the lock was frozen.

APPENDIX AIII

LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF GROUNDWATER
QUALITY MONITORING WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AIV

2005 GROUNDWATER QUALITY DATA FOR MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

TABLE AIV-1: 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-1	2/16/05	7.2	431	12	525	0.43	64
QC-1	5/19/05	7.6	862	13	531	0.35	64
QC-1	6/30/05	7.5	672	14	548	0.35	63
QC-1	8/25/05	7.5	949	13	529	0.36	61
QC-1	11/17/05	7.4	293	11	504	0.29	67
QC-1	12/15/05	Well could not be sampled					
QC-2	2/16/05	6.9	356	12	88	0.68	44
QC-2	5/19/05	7.4	490	13	96	0.99	44
QC-2	6/30/05	7.5	395	15	86	0.70	36
QC-2	8/25/05	7.2	481	15	77	0.40	30
QC-2	11/17/05	7.7	261	10	82	0.67	39
QC-2	12/15/05	7.4	442	12	78	0.21	36
QC-2.1	5/19/05	7.6	674	13	62	0.57	36
QC-2.1	6/30/05	7.6	610	17	55	0.42	34
QC-2.1	11/17/05	7.5	356	11	60	0.56	35
QC-2.2	2/16/05	7.4	361	12	41	0.54	16
QC-2.2	5/19/05	7.7	437	13	43	0.43	14
QC-2.2	11/17/05	7.6	261	11	41	0.25	15
QC-3	1/27/05	6.9	367	11	65	0.43	12
QC-3	6/2/05	7.6	495	13	63	0.39	12
QC-3	9/22/05	7.4	330	13	65	0.34	11
QC-4	1/27/05	7.1	439	10	10	0.19	10
QC-4	6/2/05	7.4	541	12	11	0.13	11
QC-4	9/22/05	7.6	340	12	10	0.13	11
QC-5	1/27/05	7.0	512	11	10	0.16	27
QC-5	3/3/05	6.8	720	12	10	0.15	30
QC-5	5/5/05	7.9	505	13	9	0.15	28

TABLE AIV-1 (Continued): 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ μmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-6	1/27/05	7.1	436	11	19	0.36	16
QC-6	6/2/05	7.4	617	13	19	0.30	15
QC-6	9/22/05	7.5	417	8	9	0.29	16
QC-7	1/27/05	7.1	509	11	15	0.27	12
QC-7	3/3/05	7.1	584	12	12	0.25	12
QC-7	7/14/05	7.6	550	14	10	0.28	11
QC-9	1/27/05	7.4	380	12	58	0.59	10
QC-9	6/2/05	7.5	397	13	60	0.21	10
QC-9	9/22/05	7.4	296	14	61	0.18	9
QC-10	1/13/05	7.7	369	12	11	0.05	31
QC-10	3/30/05	7.6	488	13	12	0.09	29
QC-10	7/13/05	7.6	376	13	13	0.10	36
QC-11	1/20/05	7.1	347	12	22	0.11	22
QC-11	3/30/05	7.6	350	13	22	0.12	21
QC-11	7/13/05	7.8	289	13	19	0.19	22
QC-12	1/20/05	6.9	1069	11	115	0.26	37
QC-12	3/30/05	7.3	1065	13	146	0.25	47
QC-12	7/13/05	7.5	701	14	200	0.30	40
QC-13	1/20/05	7.1	512	10	33	0.19	46
QC-13	3/30/05	7.4	555	13	34	0.18	48
QC-13	7/13/05	7.6	446	13	35	0.17	43
QC-14	2/16/05	7.1	475	12	111	0.27	88
QC-14	7/28/05	7.6	490	13	106	0.19	95
QC-14	9/15/05	7.7	852	13	105	0.17	85
QC-15	2/16/05	7.0	340	12	14	0.17	20
QC-15	7/28/05	8.2	292	13	13	0.19	21
QC-15	9/15/05	7.8	393	13	13	0.18	20

TABLE AIV-1 (Continued): 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ μmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-16	1/27/05	7.2	587	11	75	0.04	22
QC-16	5/5/05	7.6	370	13	74	0.07	21
QC-16	9/22/05	7.3	354	14	76	0.04	21
QC-17	6/30/05	7.6	495	13	170	0.29	13
QC-17	7/28/05	7.5	352	12	188	0.28	14
QC-17	9/15/05	7.7	643	12	187	0.27	13
QC-18	6/30/05	7.5	404	13	7	0.08	8
QC-18	7/28/05	8.7	332	12	7	0.09	8
QC-18	9/15/05	7.9	479	12	7	0.09	8
QC-19	1/27/05	7.0	565	11	114	0.27	5
QC-19	3/3/05	6.9	574	12	119	0.28	5
QC-19	7/14/05	7.4	582	13	119	0.28	4
QC-20	1/13/05			Well could not be sampled			
QC-20	3/8/05			Well could not be sampled			
QC-20	5/18/05			Well could not be sampled			
QC-20	8/25/05			Well could not be sampled			
QC-20	11/1/05			Well could not be sampled			
QC-20	12/16/05			Well could not be sampled			
QC-21	1/13/05	7.6	311	11	10	0.63	29
QC-21	3/10/05	7.5	351	11	11	0.03	17
QC-21	7/14/05	7.5	360	14	10	0.09	16
QC-22	1/13/05	7.5	255	11	26	0.18	15
QC-22	3/10/05	7.5	290	11	27	0.11	15
QC-22	7/14/05	7.6	296	13	24	0.19	14
QC-23	1/13/05	7.6	342	11	6	0.05	20
QC-23	3/10/05	7.8	401	11	7	0.04	21
QC-23	5/18/05	7.8	332	13	6	0.06	20
QC-23	7/14/05	7.9	349	14	5	0.10	20

TABLE AIV-1 (Continued): 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-23	8/25/05	7.8	436	13	6	0.10	19
QC-23	11/3/05	7.7	291	13	6	0.07	21
QC-24	1/13/05	7.5	267	12	11	0.09	26
QC-24	3/10/05	7.6	294	11	11	0.09	26
QC-24	5/18/05	7.5	256	13	11	0.10	26
QC-24	7/14/05	7.6	240	14	10	0.13	27
QC-24	8/25/05	7.6	324	13	11	0.13	26
QC-24	11/3/05	7.8	215	12	11	0.09	27
QC-25	1/13/05	7.7	257	12	18	0.16	16
QC-25	3/17/05	7.5	268	12	19	0.10	14
QC-25	7/14/05	7.9	215	14	17	0.14	14
QC-26	1/13/05	7.9	354	12	7	0.05	12
QC-26	3/17/05	7.5	327	12	7	0.07	11
QC-26	5/19/05	7.8	274	13	7	0.04	12
QC-26	7/14/05	8.0	280	14	6	0.07	12
QC-26	9/1/05	7.6	374	14	6	0.00 ²	12
QC-26	11/3/05	7.8	218	12	6	0.02	12
QC-27	1/13/05	7.5	271	12	26	0.11	32
QC-27	3/17/05	7.6	318	12	26	0.13	33
QC-27	7/14/05	7.7	256	13	23	0.16	32
QC-28	1/13/05	7.8	271	12	16	0.03	16
QC-28	3/17/05	7.6	311	12	17	0.01	29
QC-28	7/14/05	7.8	234	13	15	0.06	13
QC-29	1/6/05	7.8	475	11	149	0.54	66
QC-29	3/23/05			Well could not be sampled			
QC-29	5/5/05	7.5	632	12	156	0.48	59
QC-29	7/20/05	7.5	686	12	155	0.49	69
QC-29	9/1/05	7.5	663	14	175	0.35	71
QC-29	11/10/05	7.0	737	12	177	0.52	88

TABLE AIV-1 (Continued): 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ μmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-30	1/6/05			Well could not be sampled			
QC-30	3/23/05			Well could not be sampled			
QC-30	5/5/05	7.5	503	11	60	0.11	14
QC-30	7/20/05	7.5	532	13	63	0.10	15
QC-30	9/1/05	7.5	521	14	59	0.09	14
QC-30	11/10/05	7.2	481	11	57	0.06	16
QC-31	1/6/05	7.7	494	12	250	1.03	27
QC-31	3/23/05			Well could not be sampled			
QC-31	5/5/05	7.4	648	13	246	0.95	28
QC-31	7/20/05	7.5	669	14	244	0.92	28
QC-31	9/1/05	7.3	706	13	253	0.78	25
QC-31	11/10/05	7.4	672	12	230	0.94	21
QC-32	1/6/05	7.9	545	11	46	0.63	28
QC-32	3/23/05			Well could not be sampled			
QC-32	5/5/05			Well could not be sampled			
QC-32	7/20/05			Well could not be sampled			
QC-32	9/1/05			Well could not be sampled			
QC-32	11/10/05			Well could not be sampled			
QC-33	1/6/05			Well could not be sampled			
QC-33	3/3/05			Well could not be sampled			
QC-33	5/5/05			Well could not be sampled			
QC-33	7/14/05			Well could not be sampled			
QC-33	9/22/05			Well could not be sampled			
QC-33	10/27/05			Well could not be sampled			
QC-34	1/6/05			Well could not be sampled			
QC-34	3/24/05			Well could not be sampled			
QC-34	5/12/05			Well could not be sampled			
QC-34	7/21/05			Well could not be sampled			
QC-34	9/15/05			Well could not be sampled			
QC-34	11/10/05			Well could not be sampled			

TABLE AIV-1 (Continued): 2005 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-35	1/6/05						
QC-35	3/24/05						
QC-35	5/12/05						
QC-35	7/21/05						
QC-35	9/15/05						
QC-35	11/10/05						
QC-36	1/6/05						
QC-36	3/24/05						
QC-36	5/12/05						
QC-36	7/21/05						
QC-36	9/15/05						
QC-36	11/10/05						
QC-37	1/6/05						
QC-37	3/24/05						
QC-37	5/12/05						
QC-37	7/21/05						
QC-37	9/15/05						
QC-37	11/10/05						

¹Unfiltered samples, all others were filtered through 0.45 µm membrane.

²Zero values indicate that the test result was below the detection limit (DL). The DL for ammonia nitrogen is 0.02 mg/L.

TABLE AIV-2: 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-1	2/16/05	223	4	746	<1	-115	<48
QC-1	5/19/05	256	3	830	<1	-122	<48
QC-1	6/30/05	251	3	884	<1	-122	<48
QC-1	8/25/05	237	2	822	<1	-168	<48
QC-1	11/17/05	237	2	846	<1	-123	<48
QC-1	12/15/05	Well could not be sampled					
QC-2	2/16/05	29	4	392	120	-248	<48
QC-2	5/19/05	27	3	378	<1	-254	<48
QC-2	6/30/05	28	2	410	<1	-259	<48
QC-2	8/25/05	26	2	340	<1	-281	<48
QC-2	11/17/05	24	4	396	<1	-259	<48
QC-2	12/15/05	27	1	412	<1	-293	<48
QC-2.1	5/19/05	5	2	702	<1	-271	<48
QC-2.1	6/30/05	1	1	540	<1	-286	<48
QC-2.1	11/17/05	0 ⁴	1	496	<1	-272	<48
QC-2.2	2/16/05	32	3	336	<1	-179	<48
QC-2.2	5/19/05	105	2	388	<1	-185	<48
QC-2.2	11/17/05	34	1	382	<1	-184	<48
QC-3	1/27/05	23	1	406	1	-196	<48
QC-3	6/2/05	24	2	424	<1	-220	<48
QC-3	9/22/05	25	1	368	<1	-225	<48
QC-4	1/27/05	14	1	418	<1	-196	<48
QC-4	6/2/05	15	1	420	<1	-229	<48
QC-4	9/22/05	14	1	430	<1	-234	<48
QC-5	1/27/05	9	2	550	<1	-202	<48
QC-5	3/3/05	10	3	528	<1	-210	<48
QC-5	5/5/05	10	2	698	<1	-226	<48

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-6	1/27/05	14	3	488	<1	-202	<48
QC-6	6/2/05	14	2	526	<1	-215	<48
QC-6	9/22/05	12	1	446	<1	-217	<48
QC-7	1/27/05	4	2	392	<1	-154	<48
QC-7	3/3/05	2	2	346	<1	-165	<48
QC-7	7/14/05	2	2	418	<1	-174	<48
QC-9	1/27/05	29	2	297	<1	-141	<48
QC-9	6/2/05	30	2	362	<1	-182	<48
QC-9	9/22/05	30	1	294	<1	-180	<48
QC-10	1/13/05	1	4	402	<1	-187	<4
QC-10	3/30/05	0 ⁴	1	314	<1	-201	<4
QC-10	7/13/05	1	1	408	<1	-210	<4
QC-11	1/20/05	1	1	234	<1	-186	<4
QC-11	3/30/05	2	1	214	<1	-219	<4
QC-11	7/13/05	1	1	290	<1	-219	<4
QC-12	1/20/05	199	1	728	<1	-229	<4
QC-12	3/30/05	239	2	758	<1	-230	<4
QC-12	7/13/05	354	1	968	<1	-236	<4
QC-13	1/20/05	40	1	500	<1	-210	<48
QC-13	3/30/05	41	2	406	<1	-233	<48
QC-13	7/13/05	45	1	466	<1	-241	<48
QC-14	2/16/05	3	4	634	<1	-211	<48
QC-14	7/28/05	1	2	662	<1	-217	<48
QC-14	9/15/05	0 ⁴	2	670	<1	-217	<48

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-15	2/16/05	1	2	336	<1	-218	<48
QC-15	7/28/05	0 ⁴	1	332	<1	-227	<48
QC-15	9/15/05	1	1	426	<1	-225	<48
QC-16	1/27/05	49	1	494	<1	-194	<48
QC-16	5/5/05	54	1	570	<1	-195	<48
QC-16	9/22/05	55	0 ⁴	464	<1	-186	<48
QC-17	6/30/05	191	1	552	<1	-156	<48
QC-17	7/28/05	194	1	546	<1	-156	<48
QC-17	9/15/05	192	1	568	<1	-157	<48
QC-18	6/30/05	38	1	398	<1	-204	<48
QC-18	7/28/05	37	0 ⁴	364	<1	-203	<48
QC-18	9/15/05	33	0 ⁴	426	<1	-205	<48
QC-19	1/27/05	161	1	470	<1	-87	<48
QC-19	3/3/05	158	2	396	<1	-103	<48
QC-19	7/14/05	169	1	482	<1	-118	<48
QC-20	1/13/05			Well could not be sampled			
QC-20	3/8/05			Well could not be sampled			
QC-20	5/18/05			Well could not be sampled			
QC-20	8/25/05			Well could not be sampled			
QC-20	11/1/05			Well could not be sampled			
QC-20	12/16/05			Well could not be sampled			
QC-21	1/13/05	1	2	358	<1	-266	<48
QC-21	3/10/05	0 ⁴	7	256	<1	-266	<48
QC-21	7/14/05	1	1	350	<1	-263	<48

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-22	1/13/05	2	2	252	<1	-265	<48
QC-22	3/10/05	2	2	179	<1	-265	<48
QC-22	7/14/05	2	1	290	<1	-264	<48
QC-23	1/13/05	0 ⁴	1	330	<1	-240	<48
QC-23	3/10/05	0 ⁴	2	292	<1	-241	<48
QC-23	5/18/05	0 ⁴	1	330	<1	-240	<48
QC-23	7/14/05	1	1	348	<1	-236	<48
QC-23	8/25/05	1	0 ⁴	340	<1	-240	<48
QC-23	11/3/05	1	0 ⁴	352	<1	-240	<48
QC-24	1/13/05	0 ⁴	1	256	<1	-234	<48
QC-24	3/10/05	5	1	212	<1	-234	<48
QC-24	5/18/05	1	1	274	<1	-233	<48
QC-24	7/14/05	1	1	248	<1	-229	<48
QC-24	8/25/05	1	0 ⁴	266	<1	-233	<48
QC-24	11/3/05	0 ⁴	0 ⁴	288	<1	-233	<48
QC-25	1/13/05	1	1	244	<1	-235	<48
QC-25	3/17/05	0 ⁴	1	178	<1	-236	<48
QC-25	7/14/05	1	1	246	<1	-235	<48
QC-26	1/13/05	1	1	284	<1	-228	<48
QC-26	3/17/05	0 ⁴	1	228	<1	-228	<48
QC-26	5/19/05	1	1	294	<1	-227	<48
QC-26	7/14/05	1	1	298	<1	-228	<48
QC-26	9/1/05	2	0 ⁴	274	<1	-225	<48
QC-26	11/3/05	1	0 ⁴	276	<1	-227	<48
QC-27	1/13/05	0 ⁴	1	266	<1	-205	<48
QC-27	3/17/05	0 ⁴	1	248	<1	-206	<48
QC-27	7/14/05	1	1	254	<1	-207	<48

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON, TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-28	1/13/05	1	2	260	<1	-246	<48
QC-28	3/17/05	0 ⁴	2	272	<1	-245	<48
QC-28	7/14/05	1	1	252	<1	-245	<48
QC-29	1/6/05	90	1	564	<1	-55	<48
QC-29	3/23/05			Well could not be sampled			
QC-29	5/5/05	97	1	564	<1	-54	<48
QC-29	7/20/05	90	1	564	<1	-55	<48
QC-29	9/1/05	103	1	552	<1	-52	<48
QC-29	11/10/05	106	1	608	<1	-55	<48
QC-30	1/6/05			Well could not be sampled			
QC-30	3/23/05			Well could not be sampled			
QC-30	5/5/05	74	2	450	<1	-139	<48
QC-30	7/20/05	70	1	440	<1	-139	<48
QC-30	9/1/05	71	1	432	<1	-140	<48
QC-30	11/10/05	70	1	442	<1	-138	<48
QC-31	1/6/05	169	1	576	<1	-110	<48
QC-31	3/23/05			Well could not be sampled			
QC-31	5/5/05	169	2	550	<1	-99	<48
QC-31	7/20/05	166	1	546	<1	-100	<48
QC-31	9/1/05	172	1	544	<1	-94	<48
QC-31	11/10/05	184	1	576	<1	-94	<48
QC-32	1/6/05	49	24	740	<1	-168	<48
QC-32	3/23/05			Well could not be sampled			
QC-32	5/5/05			Well could not be sampled			
QC-32	7/20/05			Well could not be sampled			
QC-32	9/1/05			Well could not be sampled			
QC-32	11/10/05			Well could not be sampled			

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-33	1/6/05						
QC-33	3/3/05						
QC-33	5/5/05						
QC-33	7/14/05						
QC-33	9/22/05						
QC-33	10/27/05						
QC-34	1/6/05						
QC-34	3/24/05						
QC-34	5/12/05						
QC-34	7/21/05						
QC-34	9/15/05						
QC-34	11/10/05						
QC-35	1/6/05						
QC-35	3/24/05						
QC-35	5/12/05						
QC-35	7/21/05						
QC-35	9/15/05						
QC-35	11/10/05						
QC-36	1/6/05						
QC-36	3/24/05						
QC-36	5/12/05						
QC-36	7/21/05						
QC-36	9/15/05						
QC-36	11/10/05						
QC-37	1/6/05						
QC-37	3/24/05						
QC-37	5/12/05						
QC-37	7/21/05						

TABLE AIV-2 (Continued): 2005 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-37	9/15/05						Well could not be sampled
QC-37	11/10/05						Well could not be sampled

¹Unfiltered samples, all others were filtered through 0.45 µm membrane.

²Water level elevations are relative to Chicago City Datum.

³Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.

⁴A zero value indicates that the test result was below the detection limit (DL). The DLs for sulfate and total organic carbon are 0.4 mg/L and 0.3 mg/L, respectively.